

THE DUTIES OF A
LICENSED AIRCRAFT ENGINEER
WITH PARTICULARS OF THE EXAMINATIONS
FOR THE
ISSUE OF LICENCES



PRINTED AND PUBLISHED BY THE AIR REGISTRATION BOARD
BRETTENHAM HOUSE, LANCASTER PLACE,
STRAND, LONDON, W.C.2.

PRICE ONE SHILLING.

THE FUNCTIONS of a licensed engineer arise from the various official Orders and Directions which are to be found in the following Government publications:-

The Air Navigation (Consolidation) Order 1923 as amended by subsequent Orders and Provisional Orders.

Air Navigation Directions 1936 (A.N.D.13) and subsequent amendments.

Air Navigation Regulations.

Airworthiness Handbook for Civil Aircraft AP.1208 Vol.I Design, Vol.II Inspection.

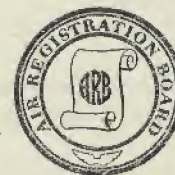
Notices to Aircraft Owners and Ground Engineers.

A.R.B. HANDBOOK No. 2

This handbook is at present issued for information only. The date on which the revised procedure for the examination for the issue of licences will be put into force, will be notified by means of a Notice to Aircraft Owners and Ground Engineers.

AIR REGISTRATION BOARD

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I

GENERAL

WHEN the Air Navigation Act was passed soon after the 1914-18 war, Parliament decided that the Government should take responsibility for the airworthiness of civil aircraft.

The person responsible for seeing that the wishes of Parliament are carried out is the Secretary of State for Air, and the law requires that he shall be satisfied that the design and construction of all British registered civil aircraft holding a British Certificate of Airworthiness or a British validation of a foreign certificate are sound, and after they have been put into service they shall be maintained in an airworthy condition.

It is obvious, that although this is a general statement of the position, it must be interpreted in accordance with practical possibilities.

The Secretary of State himself cannot be expected to examine aircraft, and therefore, he must either employ assistants to do it for him, or must delegate his duties to suitable persons, and he cannot, even with the assistance of these, be responsible for the airworthiness of *all* aircraft *all* the time.

So far as the first part of his responsibilities are concerned, he has set up a Department of Civil Aviation which does part of the work for him, and he has delegated certain of his technical responsibilities to the Air Registration Board.

As for the second part, he has ordered that a British registered aircraft, if it flies for hire or reward—that is carries passengers, mails or freight, or is used by a Flying Club for instructional purposes—must have a Certificate of Airworthiness, and must, while on service, be inspected and certified each day as being safe for flight. Privately owned aircraft must have a Certificate of Airworthiness or a Permit to Fly.

If any British registered aircraft holding a Certificate of Airworthiness suffers damage and is repaired or modified, whether following damage or not, these repairs or modifications must be

certified as having been carried out in accordance with requirements which are laid down and which are described in more detail later.

The Secretary of State for Air requires that these certificates, both of daily Safety for Flight and Repairs, must be given by persons considered by him competent to do so. He has asked the Air Registration Board to advise him whether a person is competent and to be trusted to give these certificates, and if he receives the necessary recommendation from the Board, he may issue a licence to that person confirming his competence for these purposes. In conformity with the text of existing Statutory Orders the licensee is then officially known as "Ground Engineer No." and this title must therefore be used by him when signing any official documents in his capacity as a licence holder.

It may be that a person is licensed for the purpose of certifying an airframe or engine before flight or only for the purpose of certifying repairs, overhauls, modifications or replacements. On the other hand, if his knowledge and experience warrant it, he may be licensed to give all the certificates which the regulations require.

If at any time, while acting on behalf of the Secretary of State for Air, he fails to use properly, and in accordance with the regulations, the powers that have been given to him, his licence may be cancelled or suspended. His position is one of great responsibility and the lives of passengers in an aircraft may depend on the quality of his inspection and the integrity of his certification.

The increasing size and complexity of modern aircraft require that considerable practical experience is necessary and a sufficiency of theoretical knowledge, to ensure that the licensed engineer will not make serious mistakes for lack of knowledge of what he is doing.

At one time it was required that he should have an intimate knowledge of, and have worked on, the particular type of aircraft for which his licence was valid, but with the large variation of types, this system has become impracticable and he is now required to have sufficient general knowledge and experience to ensure that he is competent to judge whether aircraft of all types (or in the case of a "restricted" licence, of aircraft on a published list), are safe to fly.

Limitations are put on the complexity of the airframe or engine that he may certify until he has had more experience, but the principle underlying his qualification to hold a licence is that he

should have a sound general knowledge of aeronautical engineering and have had satisfactory experience of aircraft of the class for which he is licensed. It is not less important that he should be a responsible person, and as a partial guarantee of this the regulations therefore lay down that he should not be under twenty-one years of age.

Before dealing with the various categories of licence which may be granted, it is necessary to make it clear that in all cases the licence simply authorises the holder to inspect and certify. It is not, and should not be regarded as, a certificate of competence to do any work required to render the aircraft or engines fit for certification.

In fact the holder of the licence may also be the person who does any work that may be required but, if this be so, he is acting in a dual capacity—that of workman and inspector—and this sometimes makes his position difficult. He may be employed to do the work because he happens to be competent to certify, but, if after the work is finished, he inspects and certifies it, then at that point, the licence holder is acting under the authority which is given to him by the Secretary of State for Air.

II

APPLICATION FOR A LICENCE

A CANDIDATE who wishes to be examined for a licence should first make application to the Secretary, Air Registration Board, Brettenham House, Lancaster Place, Strand, W.C.2. when he is sent a preliminary form on which he is asked to give brief details of his experience. The object of this is to enable the Board to decide whether a formal application from him could be accepted. If his qualifications appear to be of the required standard he is then sent an application form on which he is required to give his age and particulars of any training he has received at

a technical college, evening class, R.A.F. School, or elsewhere. He is also required to give particulars of any apprenticeship he may have served, and practical experience he may have had, showing the names of his employers, the dates of employment, and the capacities in which he was engaged. He is required to produce references, one of which should be from an employer or a licensed engineer, as to his technical qualifications, and one from a person of standing who is prepared to express an opinion as to his general suitability to undertake the responsibilities of a licensed engineer.

When his application has been accepted by the Board, the candidate is notified of the time and place of examination. Examinations are normally held in London at regular intervals but additional examinations are arranged at other places if the number of applications from a particular district warrants it.

The examination consists of two parts—written and oral—which may or may not be held on the same day.

In the event of failure the candidate may be allowed to sit the next examination or may be required to wait for a period before re-examination as the examining board recommends.

A separate application for examination must be made in respect of each category, or in the case of Category "X" in each sub-division and a candidate will only be examined in one category or sub-division at a time.

In the event of failure a candidate must make fresh application which must be accompanied by the appropriate statutory fee.

The fees for the examination and issue of licences are as shown later in this handbook.

III

CATEGORIES OF LICENCE

LICENCES are issued to cover duties in the following categories:-

"A"-Certification of Safety for Flight (airframes only) and of certain permitted minor repairs, modifications and replacements to airframes.

"B"-Certification of airframes after overhaul and of major repairs or modifications.

In these categories the licence may be issued to cover all types of airframe, or may be restricted to specified types, a list of which will be published. It may also be restricted to the airframes of land or marine aircraft.

"C"-Certification of aircraft engines before flight and of minor repairs, modifications and replacements.

"D"-Certification of aircraft engines after overhaul and of major repairs or modifications.

The "C" and "D" licences may similarly be issued to cover all aircraft engines or may be restricted to specified types, a list of which will be published. They may also be restricted to cover air-cooled or liquid-cooled engines.

"X"-Certification of the overhaul, repair or modification of various items of equipment.

The duties of engineers licensed in these categories are detailed in the official publications listed on the cover of this handbook and an applicant for a licence in any category will be required to show that he has a good general knowledge of these requirements and in particular of those which specially apply to the category in which the licence is desired.

These publications can be obtained from H.M. Stationery Office, Kingsway, London, W.C.2. or through any Bookseller. When purchasing them, applicants should be careful to obtain any amendments to them which may have been issued.

IV

DUTIES OF ENGINEERS LICENSED IN CATEGORIES "A" AND "C"

DAILY CERTIFICATES OF SAFETY FOR FLIGHT.

THE MOST important duty which the engineer licensed in Category "A" or "C" is required to discharge, is the granting of the Daily Certificate of Safety for Flight.

The Air Navigation (Consolidation) Order, 1923, and subsequent amendments, provide that an aircraft registered in Great Britain and Northern Ireland and carrying passengers or goods for hire or reward, or used by a Flying Club for instructional purposes, shall not fly unless it has within twenty-four hours, been inspected and certified as safe for flight.

The only exception to this requirement is that, if an aircraft lands due to an accident, stress of weather or other unavoidable cause, it may, with certain provisos, complete its journey if the pilot is satisfied that it is safe for the proposed flight.

The Daily Certificate of Safety for Flight is normally given in the following terms:-

CERTIFICATE OF SAFETY FOR FLIGHT

Aircraft Type

Nationality and Registration Marks

- (a) I hereby certify that I have this day inspected the above aircraft (including its prescribed instruments and equipment but exclusive of the engine(s) and engine installation and of the instruments relating thereto) and that I am satisfied that it is safe in every way for flight, provided that the conditions of

loading specified in the certificate of airworthiness are complied with.

The time at which this inspection was completed was

Signed

Ground Engineer No.

Date..... Time.....

- (b) And I hereby certify that I have this day inspected the engine(s) and engine installation (including the prescribed instruments relating thereto) of the above aircraft and that I am satisfied that they are in every way fit for flight.

The time at which this inspection was completed was

Signed

Ground Engineer No.

Date..... Time.....

It can be signed only by engineers who are suitably licensed in Categories "A" and "C".*

This certificate is only given after a thorough inspection of the aircraft has been carried out by them, but it is not possible nor desirable to specify the particular items which should be examined before the certificate is granted. If necessary the inspection should cover the whole aircraft, but naturally, the extent of it will depend on the engineer's possible previous or continued knowledge of the particular airframe or engine for which certification is given.

A licensed engineer's experience, training and examination, ensure that he has a sufficient knowledge of what inspection is required, but he finds the best and greater part of his guidance in the instructions which are issued by aircraft and engine constructors usually in handbook form. Even these must be regarded only in the nature of guidance, and compliance with any information

* See Notice to Aircraft Owners and Ground Engineers No. 35 of 1938.

which may be published in this form or through "ground engineers' notices," does not absolve the licensee from personal responsibility when he states that the aircraft is safe in every way for flight.

This Daily Certificate of Safety for Flight is one which can be given by individuals after their own inspection, and it is a suitable safeguard in the case of a small aircraft which can be inspected by them within a reasonable time.

This form of certificate shows that all inspection carried out must be done by the person who signs the certificate. In the case of large aircraft however, it is obviously impossible for one man to do all the inspection, and by an amendment to the Air Navigation Directions dated 1st September 1941, the following alternative form of certificate was introduced:-

CERTIFICATE OF SAFETY FOR FLIGHT

*Flying Machine Type.....

Nationality and Registration Marks

- (a) I hereby certify that the above flying machine (including its prescribed instruments and equipment but exclusive of the engine(s) and engine installation and of all instruments relating thereto) has this day been inspected under my supervision and that I am satisfied that it is safe in every way for flight provided that the conditions of loading specified in the Certificate of Airworthiness are complied with.

The time at which this inspection was completed was

Signed

Ground Engineer No.

Date..... Time.....

* Note:- The Substitution of "flying machine" for "aircraft" was made by the Air Ministry when this form of certificate was approved. The reason for this substitution is not known, but, it is not to be inferred that the term "flying machine" was intended as defining a size or category of aircraft.

- (b) And I hereby certify that the engine(s) and engine installation (including the prescribed instruments relating thereto) of the above flying machine have this day been inspected under my supervision and that I am satisfied that they are in every way fit for flight.

The time at which this inspection was completed was

Signed

Ground Engineer No.

Date..... Time.....

This form of certificate can be used only with the written permission of the Secretary of State for Air which may be obtained from the Air Ministry on recommendation of the Board.

The Secretary of State is prepared to grant this permission only in the case of large aircraft and when the operating company has an efficient inspection organisation.

As will be seen from the wording of this certificate, the inspection may, in this case, be carried out by several people, but the certificate must still be signed by engineers suitably licensed in Categories "A" and "C" and it must not be assumed that, because some of the inspection has been done for them that they are relieved of personal responsibility.

They must have a knowledge of the inspection required on the airframe or engines in question and have such measure of control as will enable them to ensure that complete inspection has been carried out.

CERTIFICATES OF FITNESS FOR FLIGHT (SUBSEQUENT AIRCRAFT).

The first of a particular type of aircraft is called a "Type" aircraft and, after it has been fully approved and granted a Certificate of Airworthiness, it serves as a pattern for "Subsequent" aircraft which in turn will be granted Certificates of Airworthiness if they conform in all respects to the "Type".

In the case of "Subsequent" aircraft produced by an aircraft constructor under these conditions, it is required that before flight, a licensed engineer should inspect each aircraft and issue a Certificate of Fitness for Flight.

The Air Navigation Directions require that on completion of the construction of the aircraft and of Constructors' flying trials, a final inspection of the aircraft to determine its fitness for flight shall be made by a representative or representatives of the constructors holding engineer's licences in Categories "A" and "C" for the class of aircraft concerned, and, if the result of this inspection warrants it, a Certificate of Safety for Flight, in a form satisfactory to the Secretary of State, shall be furnished by them.

The certificate referred to in this Direction is contained in the Civil Aircraft Inspection Record of the aircraft (A.R.B. Form 68) and is in the following terms:-

CERTIFICATE OF FINAL INSPECTION FOR FITNESS FOR FLIGHT

I hereby certify that the aircraft defined herein has this day been inspected and is safe in every way for flight.

Signed.....Date.....

Ground Engineer No.

Signed.....Date.....

Ground Engineer No.

The first signature required is that of an engineer licensed in Category "A" and the second must be that of an engineer licensed in Category "C". These inspections should be of the same nature as that carried out for the Daily Certificate of Safety for Flight of the "hire or reward" aircraft.

OVERHAULS, REPAIRS, ETC.

In addition to the furnishing of the certificates referred to above, the engineer licensed in Category "A" or "C" is permitted to certify, within certain limitations, overhauls, repairs, replacements and modifications, in accordance with the requirements of the Air Navigation Directions.

These require that, after the work has been done, and before the aircraft again flies, particulars of any overhaul, repair, modification

or replacement to the airframe or engine(s), must be entered in the airframe or engine log book and that to such particulars must be appended a certificate in the following form:-

I hereby certify that in carrying out

the { overhaul
repair
modification
replacement

specified above, all the conditions and requirements applicable thereto under the Air Navigation Act 1920 as amended by any other enactment, have been complied with.

Signed

Date

This certificate, when relating to the airframe, may be signed by an engineer licensed in Category "A" only under the following conditions:-

OVERHAUL. When the overhaul does not involve repair, modification or replacement, except as stated hereunder as coming within the scope of the duties of an engineer licensed in Category "A".

REPAIRS. When minor repairs have been done which do not affect the main structure of the airframe, and provided that any parts or materials used for them have been certified by an Approved firm or by an engineer licensed in Category "B".

MODIFICATIONS. When a modification has been made which has been approved as "minor" by the Air Registration Board.

REPLACEMENTS. When a complete part or component which has been certified by an Approved firm or by an engineer licensed in Category "B", has been fitted.

An engineer licensed in Category "C" may sign the certificate when it relates to the engine(s) only under the following conditions:-

OVERHAULS. When the overhaul requires minor rectifications

which only involve dismantling sufficient to allow access to the pistons, cylinder and valve operating gear.

MODIFICATIONS. When a modification has been made which has been approved as "minor" by the Air Registration Board.

REPLACEMENTS. When within the "minor rectification" limits of dismantling, a replacement has been fitted which has been certified by an Approved firm or by an engineer licensed in Category "D".

V

REQUIREMENTS FOR CANDIDATES MAKING APPLICATION FOR A LICENCE IN CATEGORY "A"

CATEGORY "A" (RESTRICTED) authorises the holder to carry out the duties set out on page seven on airframes of aircraft included in a list published from time to time.

The intention of making this Restricted Licence available, is to assist men to obtain a position in the industry which would give them sufficient experience to qualify for a licence in Category "A", and to suit the engineer who does not desire to obtain a higher qualification because the requirements of his position make it unnecessary.

An applicant must be not less than twenty-one years of age and have had at least three years' approved aeronautical experience, including a minimum of one year's practical experience on aircraft maintenance.

In the written examination he will be required, in addition to showing a satisfactory knowledge of practical mathematics, to satisfy the examiners as to his knowledge of :-

- (a) the maintenance of the airframe and such of its equipment as is his responsibility under the regulations.
- (b) various terms used in aircraft construction and aerodynamics and an elementary knowledge of the functioning of each component part of an aircraft.

- (c) the initial assembly of the airframe structure with particular reference to the assembly and functioning of controls on the ground.
- (d) the adjustment of the control surfaces for the purpose of rectifying faults experienced in flight as a result of defect or maladjustment.
- (e) functioning of electrical and other equipment fitted to the aircraft on the "restricted" list.
- (f) defects and deterioration in wing coverings, timber and metal structures and methods of rectification within the limits of his licence.
- (g) the principles and functioning of shock absorbing devices of undercarriages.
- (h) the methods of effecting minor repairs and replacements defined as his responsibility by the regulations.
- (j) the general principles of the instruments fitted to the aircraft as required by the regulations, and their proper installation and functioning.
- (k) the preparation of a brief report, illustrated by rough sketches if necessary, in order to describe the replacements or repairs required in the case of damage.

CATEGORY "A" authorises the holder to carry out the duties of a licensed engineer on *all* land or marine aircraft, or both land and marine aircraft.

An applicant must be not less than twenty-one years of age and have had at least five years' approved aeronautical experience including a minimum of two years' practical experience, one of which must have been spent on the maintenance of an airframe of an aircraft not on the "restricted" list and of the class for which a licence is desired.

The syllabus for the written examination is as for the "restricted" licence, but the standard of knowledge required will be higher and will include questions particularly relating to aircraft of the larger types and of the particular class for which a licence is desired.

The oral examination for all classes of licence, is designed not only to assess the candidate's practical knowledge but also to afford him an opportunity of improving on a written examination in which he may not have done himself full justice. In this examination he will be required to demonstrate his practical knowledge of inspection and the use of measuring instruments.

VI

REQUIREMENTS FOR CANDIDATES MAKING APPLICATION FOR A LICENCE IN CATEGORY "C"

CATEGORY "C" (RESTRICTED) authorises the holder to carry out the duties set out on page seven on aircraft engines included in a list published from time to time.

The intention of making this Restricted Licence available, is to assist men to obtain a position in the industry which would give them sufficient experience to qualify for a licence in Category "C", and to suit the engineer who does not desire to obtain a higher qualification because the requirements of his position make it unnecessary.

An applicant must be not less than twenty-one years of age and have had at least three years' approved engineering experience which must have included a minimum of one year's practical experience on the maintenance of engines installed in aircraft. In the written examination he will be required, in addition to showing a satisfactory knowledge of practical mathematics, to satisfy the examiners as to his knowledge of:-

- (a) the principles of operation of internal combustion petrol engines and the general construction of current types of aircraft engines.
- (b) the method of inspection during overhaul, within the limits laid down, the defects likely to be encountered and their rectification, and the permissible allowances for wear or distortion.
- (c) the inspection, adjustment and testing of the engine and its accessories after overhaul to ensure correct functioning and power output.
- (d) the inspection of the engine and its accessories during and after installation in the aircraft and during daily maintenance, including fixed pitch propellers, magnetos, carburettors, pumps, filters, engine starting mechanism and any other components, on which the correct functioning of the engine depends.

- (e) the methods of inspecting and testing the installations of the instruments connected with the engine.
- (f) the use of the equipment required to test the engine during and after overhaul.

CATEGORY "C" authorises the holder to carry out the duties of a licensed engineer on *all* air-cooled, or liquid-cooled or both air and liquid cooled, petrol aircraft engines.

An applicant must be not less than twenty-one years of age and have had at least five years' approved engineering experience including a minimum of two years' practical experience on the maintenance of engines installed in aircraft, one of which must have been spent on the maintenance of an engine not on the "restricted" list and of the class for which a licence is desired.

The syllabus for the written examination is as for the "restricted" licence with the following additions:-

- (g) the principles of supercharging and the operation of superchargers.
- (h) the principles and operation of variable-pitch propellers, including the ground testing of the engines to which they are fitted.

The oral examination for all classes of licence will be designed not only to assess the candidate's practical knowledge but also to afford him an opportunity of improving on a written examination in which he may not have done himself full justice. In this examination he will be required to demonstrate his practical knowledge of inspection and the use of measuring instruments.

VII

DUTIES OF ENGINEERS LICENSED IN CATEGORIES "B" AND "D"

OVERHAUL, REPAIR, MODIFICATION OR REPLACEMENT.

AS PREVIOUSLY explained, the Secretary of State for Air requires that any overhauls, repairs, modifications or replacements made to an aircraft to which a Certificate of Airworthiness has been granted must be certified if the validity of the Certificate of Airworthiness is to be maintained.

This certification must be carried out by an appropriately licensed engineer or by a firm which has been approved for the purpose by the Air Registration Board.

In the extract from the Air Navigation Directions which follows, it should be noted that the word "aircraft" includes the engine or engines and any instruments or equipment which may be prescribed by the regulations for an aircraft engaged on a particular service or flight.

Modern practice, owing to the complexity of aircraft, tends to make use of certification by an Approved firm rather than by an individual licensed engineer, but the extent of the experience and knowledge necessary before an individual can obtain a licence are based on the assumption that he is competent to certify an overhaul, repair, modification or replacement which is carried out by an unapproved organisation. It is therefore necessary that he should have a knowledge of the material used, the correct manufacturing processes involved, and the correct functioning of the whole, when the defective part has been replaced or repaired.

The particular regulation requires that:-

"When an aircraft registered in Great Britain and Northern Ireland in respect of which a Certificate of Airworthiness has been issued or validated by the Secretary of State is overhauled, repaired or modified or when any part thereof is replaced, the aircraft shall not again fly (except in so far as under the Order it might fly if it had no Certificate of

Airworthiness) unless and until the following conditions have been complied with:-"

These conditions, summarised and with certain provisos, are that:-

- (i) The work must be in all essential respects in accordance with either:-
 - (a) the approved type design in conformity with which the aircraft was constructed, or
 - (b) a repair scheme approved by the Air Registration Board.
- (ii) In the case of repairs, overhauls, replacements or modifications, all material used must be an approved equivalent to that authorised for the type design in conformity with which the aircraft was constructed.
- (iii) In all cases, all work must be inspected in accordance with the conditions required for the inspection of subsequent aircraft that are applicable to the case.
- (iv) In all cases a certificate must be appended to particulars of the overhaul, repair, modification or replacement to which it relates and is in the following form:-

"I hereby certify that in carrying out

the { overhaul
repair
modification
replacement

specified above, all the conditions and requirements applicable thereto under the Air Navigation Act 1920 as amended by any other enactment, have been complied with.

Signed.....

Date"

Such certificates must, when relating to the airframe or instruments or equipment, be written in the aircraft log book and, when relating to the engine or engines, be written in the engine log book, and signed by an engineer qualified under the terms and conditions of his licence to certify the overhaul, repair, modification or replacement to which the certificate relates or by the authorised representative of a firm or company approved for the purposes of signing such certificates.

VIII

REQUIREMENTS FOR CANDIDATES MAKING APPLICATION FOR A LICENCE IN CATEGORY "B"

CATEGORY "B" (RESTRICTED) authorises the holder to carry out the duties set out on page seven on airframes of aircraft included in a list published from time to time.

The intention of making this Restricted Licence available is to assist men to obtain a position in the industry which would give them sufficient experience to qualify for a licence in Category "B", and to suit the engineer who does not desire to obtain a higher qualification because the requirements of his position make it unnecessary.

An applicant must be not less than twenty-one years of age and have had at least three years' approved aeronautical experience which must have included one year's general practical experience with an organisation approved for the manufacture or the overhaul and repair of airframes.

In the written examination he will be required, in addition to showing a satisfactory knowledge of practical mathematics, to satisfy the examiners as to his knowledge of:-

- (a) the various terms used in aircraft construction and aerodynamics and a knowledge of the functioning of each component part of an aircraft.
- (b) the materials, metallic and non-metallic, commonly used in airframe construction, with the methods of examination and testing necessary to ensure compliance with specification requirements, also the workshop processes applicable to such materials during manufacture, including glueing, doping, and, in the case of metals, heat-treatment, welding, soldering, plating or other protective treatment.
- (c) the inspection, during construction, of airframe parts and components (fuselages, wings, fixed pitch propellers, tanks, radiators, etc.).
- (d) the general principles of electricity and magnetism and the inspection of the installation and functioning (as far as is

practicable on the ground) of the instruments and electrical equipment.

- (e) the construction and functioning of shock absorbing devices of undercarriages.
- (f) the inspection of the installation of the engine, including the controls, and the fuel, oil and water system.
- (g) the inspection of the complete aircraft for correct assembly.
- (h) the methods of determining the weight and centre of gravity position of the aircraft and preparation of a weight schedule.
- (j) the preparation of a sketch from which a finished drawing could be made.

CATEGORY "B" authorises the holder to carry out the duties of a licensed engineer on *all* airframes of land or marine aircraft or of both land and marine aircraft.

An applicant must be not less than twenty-one years of age and have had at least five years' approved aeronautical experience including a minimum of two years' general practical experience with an organisation approved for the manufacture or the overhaul and repair of airframes, one of which must have been on the manufacture or overhaul and repair of an airframe of an aircraft not on the "restricted" list and of the class for which a licence is desired.

The syllabus for the written examination is as for the "restricted" licence, but the standard of knowledge required will be higher and the examination will include questions particularly relating to aircraft of the larger types and of the class for which a licence is desired.

The oral examination is designed to assess the candidate's practical knowledge but also to afford him an opportunity of improving on a written examination in which he may not have done himself full justice.

In this examination he will be required to demonstrate his practical knowledge of measuring instruments and the interpretation of drawings.

REQUIREMENTS FOR CANDIDATES MAKING APPLICATION FOR A LICENCE IN CATEGORY "D"

CATEGORY "D" (RESTRICTED) authorises the holder to carry out the duties set out on page seven on aircraft engines included in a list published from time to time.

The intention of making this Restricted Licence available is to assist men to obtain a position in the industry which would give them sufficient experience to qualify for a licence in Category "D", and to suit the engineer who does not desire to obtain a higher qualification because the requirements of his position make it unnecessary.

An applicant must be not less than twenty-one years of age and have had at least three years' approved engineering experience which must have included a minimum of one year's general practical experience with an organisation approved for the manufacture or for the overhaul and repair of aircraft engines.

In the written examination he will be required, in addition to showing a satisfactory knowledge of practical mathematics, to satisfy the examiners as to his knowledge of:-

- (a) the principles of operation of internal combustion petrol engines and a good general knowledge of the construction of current types of in-line and radial engines.
- (b) the method of inspection of engines during overhaul, the defects likely to be encountered and their correction, the permissible allowances for wear or distortion and the balancing of parts.
- (c) the materials, ferrous and non-ferrous, commonly used in engine construction and the methods of examination and testing necessary to ensure compliance with specification requirements. The workshop processes applicable to such materials during engine manufacture, including heat treatment and case hardening, and the methods of protection against deterioration.
- (d) the methods of testing engines after overhaul, including the

- measurement of horse power and fuel and oil consumption.
- (e) the methods of inspecting and checking the correct functioning of the ignition, carburation, lubrication, cooling and air-screw control system.
- (f) the preparation of a sketch from which a finished drawing could be made.

CATEGORY "D" authorises the holder to carry out the duties of a licensed engineer on *all* air-cooled or liquid cooled, or both air-cooled and liquid cooled petrol aircraft engines.

An applicant must be not less than twenty-one years of age and have had at least five years' approved engineering experience, including a minimum of two years' practical experience of aircraft engine construction or overhaul of an aircraft engine not on the "restricted" list or of the class for which a licence is desired.

The syllabus for the written examination is as for the "restricted" licence, but the standard of knowledge required will be higher and will include questions particularly relating to aircraft engines not on the "restricted" list, to supercharging and to the class of engine for which a licence is desired.

The oral examination is designed to assess the candidate's practical knowledge but also to afford him an opportunity of improving on a written examination in which he may not have done himself full justice.

In this examination he will be required to demonstrate his practical knowledge of measuring instruments and the interpretation of drawings.

DUTIES OF AIRCRAFT ENGINEERS LICENSED IN CATEGORY "X"

ENGINEERS licensed in Categories "A", "C", "B" and "D", are expected to have a general knowledge of all the instruments and equipment and their functions, employed in civil aircraft. This is sufficient to enable them to exercise their certifying powers in respect of the whole assembly, but the growing complexity both of instruments and of auxiliary plant and equipment has made it necessary, in the interests of safety in flight, to create a "Specialist" class of licence to cover the overhaul and repair of specific items. This enables the "A", "C", "B" or "D" Category engineer to obtain a supporting certificate from a specially qualified source before he signs his own clearance whether of fitness for flight or for overhaul of airframe or engine.

To this category the general description of "X" is applied, the particular items in respect of which it is issued taking the form of individual endorsements. An "X" licence may be held by a genuine specialist with a single endorsement only, but there is nothing to prohibit a collection of such endorsements by one man nor, of course, the possession of an "X" licence by an engineer licensed in "A", "C", "B" or "D" Category.

The items for which "X" licence endorsements are at present issued by the Board include those for which a certificate by an "X" Category engineer is compulsory under existing Air Navigation Directions.

For example:-

An engineer licensed in Category "A" may not sign the Daily Flight Certificate for an aircraft, which carries a compass as one of the instruments prescribed by Statutory Order, unless he has previous evidence of the certification of the adjustment of the compass by an engineer licensed for this purpose in Category "X".

Similarly, an engineer licensed in Category "C" may not give the necessary clearance for an engine fitted with a new or reconditioned variable pitch propeller, unless he is able to

produce the authority of an Approved firm or engineer licensed in Category "X" for variable pitch propellers which would be recorded in the propeller log book.

Again, the "A" or "B" licensed engineer must have the support of an "X" licence man or an Approved firm for the overhaul or repair of electrical equipment and instruments, and the "D" licensed engineer must have a release note from an Approved firm or the certificate of an "X" licensed engineer for the overhaul of electrical equipment associated with the engine, including the magnetos.

From this it will be seen that for the adjustment of compasses, the overhaul, repair or modification of electrical services or instruments, magnetos or variable pitch propellers, a certificate given by an engineer in Category "X" or a release note issued by a firm appropriately Approved, is necessary under existing regulations. But the range of such items may well be expected to grow and consequently it is the policy of the Board to keep ahead of developments and to offer an "X" licence endorsement in respect of any instrument or auxiliary whose complexity appears to warrant it.

"X" licences serve two purposes.

- (a) to provide the assurance necessary to the "A", "B", "C" and "D" licensed engineer that all items of equipment which have been overhauled, have been inspected in accordance with the regulations,
- and (b) to provide a standard of competence for the inspection staff of a firm approved to carry out such overhauls.

The exact part which an "X" licence plays in this second case is fully explained in the Board's regulations governing the Approval of firms and the usefulness of the "X" licensed engineer in a large organisation such as is referred to in Section IV of this handbook, is obvious.

A licence in Category "X" may be granted to cover the inspection of one or more specific items of equipment fitted to aircraft and the list of these items is published from time to time. The Board is prepared to consider applications for items not included in this list and candidates desiring such on their licences should make special application.

REQUIREMENTS FOR CANDIDATES MAKING APPLICATION FOR A LICENCE IN CATEGORY "X"

IT IS NOT possible to give a detailed syllabus to cover the requirements in each case but in general the candidate must:-

- (a) be at least twenty-one years of age.
- (b) have had practical experience of inspection during construction obtained either by direct employment or by attendance at an approved course of instruction.
- or
- (c) have had practical experience of inspection during overhaul and repair of the particular item for which application for the licence is made.

A candidate will be required to satisfy the examiners that he has a satisfactory knowledge of:-

- (a) any published inspection and testing requirements applicable to the particular item.
- (b) the materials used and the works processes involved during construction with the methods of examination and testing necessary to ensure compliance with specification requirements.
- (c) methods of installation, adjustment or calibration.
- (d) the use of measuring instruments.
- (e) the interpretation of drawings.
- (f) the preparation of a sketch from which a finished drawing could be made.

RENEWAL OF LICENCES

THE EXAMINATIONS which precede the issue of a licence in any category are a guarantee of the holder's knowledge at the time when the licence is issued, but the regulations require that licences should be renewed. This is done normally every twelve months to ensure that duties undertaken by the holder of the licence are such as to enable him to maintain his knowledge by following developments in the items for which he is licensed.

When the holder of a licence is using it to meet the requirements of the Air Navigation Directions, the duties of the Surveyors to the Air Registration Board bring them into contact with the licence holder and they are therefore able, from time to time, to make reports so that on the expiry of his licence the Board is in a position to decide whether it should be renewed.

In many cases the holders of licences do not have an opportunity of using them for the purpose for which they are required by the regulations. In such event the work of the holder of the licence may not come under the direct observation of the Board. In such cases the Board asks for a report either from the Chief Inspector of an Approved firm with which the holder is employed or from some other responsible person who has sufficient knowledge of his work to enable the Board to consider the renewal of the licence.

In order that holders of licences may be advised of alterations in the restricted list and other information in which they are interested, and also of the expiry of their licence, it is necessary that they should communicate any change of address to the Secretary, Air Registration Board, Brettenham House, Lancaster Place, Strand, W.C.2.

XIII

FEES FOR THE EXAMINATION AND THE ISSUE OF LICENCES

	£	s	d
FOR THE examination and issue of a licence in one class of Categories "A", "B", "C" and "D", or to cover one sub-division of Category "X".	2	0	0
For each additional class or sub-division.	2	0	0
For Renewal of Licence.			
Without examination	1	0	0
With examination	2	0	0

NOTICES TO AIRCRAFT OWNERS AND GROUND ENGINEERS

The above series of Notices have been cancelled and replaced by "NOTICES TO LICENSED GROUND ENGINEERS AND TO OWNERS OF CIVIL AIRCRAFT" issued by the Air Registration Board.